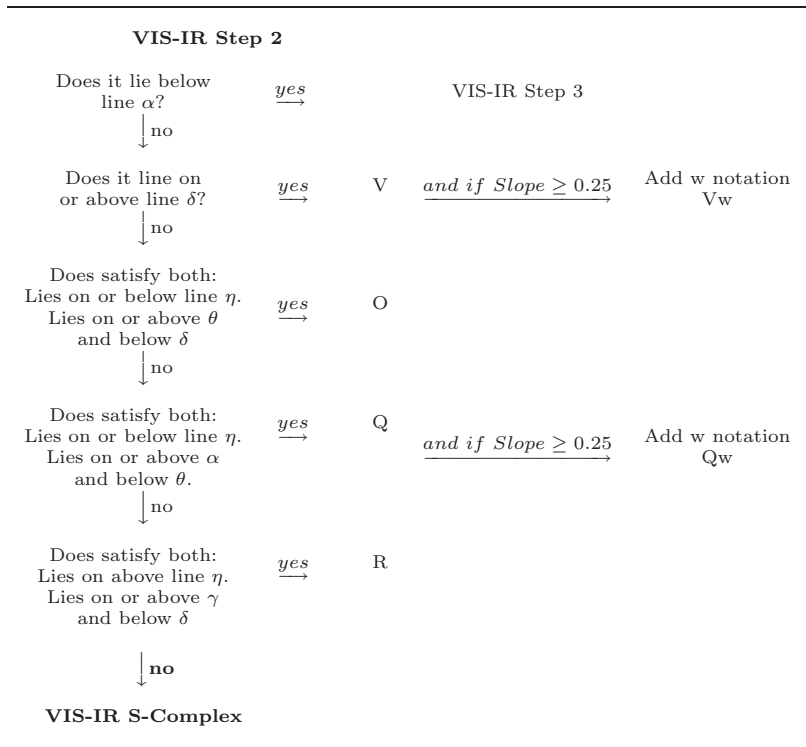


Table 1: Visible + IR Flowchart

VIS-IR Step 1		
Does it satisfy all: PC1' < -0.30 PC3' ≥ 0.20 Slope ≥ 0.40	\underline{no}	VIS-IR Step 2
↓ yes		
Does it satisfy: 0.55 ≤ Slope < 1.5	\underline{yes}	A
↓ no		
Does it satisfy: 0.40 ≤ Slope < 0.55	\underline{yes}	Sa
↓ no		
Indeterminate		



VIS-IR Step 3

Does it satisfy both:
 $0.38 \leq \text{Slope} < 1.5$
 $-0.44 < \text{PC1}' < 0.4$

$\xrightarrow{\text{yes}}$

D

A: Prominent $1\text{-}\mu\text{m}$ feature

\downarrow no

Does it satisfy all:
 $0.25 < \text{Slope} < 0.38$
 $-0.28 < \text{PC2}' < -0.20$
 $-0.20 < \text{PC3}' < -0.12$

$\xrightarrow{\text{yes}}$

T

\downarrow no

Does it satisfy both:
 $0.07 < \text{PC1}' < 1.00$
 $-0.5 < \text{PC2}' < -0.15$

$\xrightarrow{\text{yes}}$

L, Xe

Xe: Shows feature at $0.49\mu\text{m}$.

\downarrow no

Does it satisfy all:
 $-0.075 < \text{PC3}' < 0.14$
 $-0.20 \leq \text{PC2}' < -0.10$
 $-0.80 < \text{PC1}' < -0.10$

$\xrightarrow{\text{yes}}$

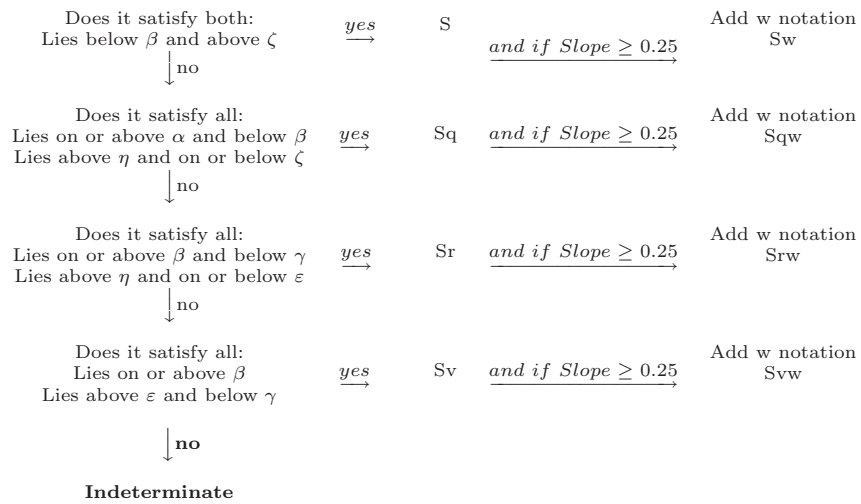
K, Xe

Xe: Shows feature at $0.49\mu\text{m}$.

\downarrow no

VIS-IR C- and X-Complexes

VIS-IR S-Complex



VIS-IR C- and X-complexes

Does it satisfy all: -0.2 < Slope < 0 -1.2 < PC1' < 0 PC4' < 0	\xrightarrow{yes}	B	
↓no			
Does it satisfy: 0.2 < Slope < 0.38	\xrightarrow{yes}	X, Xk, Xe, C	X: Featureless Xk: Shows feature between 0.8 - 1 μm . Xe: Shows feature at 0.49 μm . C: Shows feature between 1 - 1.3 μm .
↓no			
Does it satisfy all: 0.01 < PC4' < 0.14 -0.75 < PC1' < -0.27 Reflectance at 0.45 μm < 0.92.	\xrightarrow{yes}	Cgh,Xk	Cgh: Shows feature at 0.7 μm . Xk: Shows feature between 0.8 - 1 μm .
↓no			
Does it satisfy both: 0.01 < PC4' < 0.14 -0.75 < PC1' < -0.27	\xrightarrow{yes}	Ch, Xk	Ch: Shows Shows feature at 0.7 μm . Xk: Shows feature between 0.8 - 1 μm .
↓no			
Does it satisfy both: -0.04 < PC4' < 0.02 -0.07 < PC5' < -0.04	\xrightarrow{yes}	Cb	
↓no			
Does it satisfy both: -0.85 < PC1' < -0.45 -0.06 < PC5' < 0.02	\xrightarrow{yes}	C, Ch, Xk	C: Shows feature between 1 - 1.3 μm . Ch: Shows feature at 0.7 μm . Xk: Shows feature between 0.8 - 1 μm .
↓no			
Does it satisfy both: 0.02 ≤ PC5' < 0.1 -0.60 < PC1' < -0.16	\xrightarrow{yes}	Cgh, Cg, Xk	Cgh: Shows feature at 0.7 μm . Xk: Shows feature between 0.8 - 1 μm .
↓no			
Does it satisfy both: -0.45 ≤ PC1' < 0.1 -0.06 < PC5' < 0.05	\xrightarrow{yes}	Xk, Xc, Xe,C, Ch	Xk: Shows feature between 0.8 - 1 μm . Xc: Featureless. Xe: Shows feature at 0.49 μm . C: Shows feature between 1 - 1.3 μm . Ch: Shows Shows feature at 0.7 μm .
↓no			
Does it satisfy both: -0.1 ≤ PC1' < 0.3 -0.5 < PC2' < -0.2	\xrightarrow{yes}	Xe, L	Xe: Shows feature at 0.49 μm .
↓no			
Indeterminate			

VIS-IR Checks ¹ for Cg, Cgh, Ch, Xc, Xe, Xk		VIS-IR Equations	
Cg	Strong UV absorption feature before 0.55 μm	$PC1' = -3PC2' - 0.28$	Line α
Ch	Moderately shallow absorption feature around 0.7 μm	$PC1' = -3PC2' + 0.35$	Line β
Cgh	Strong UV absorption feature like Cg and 0.7- μm feature like Ch (Reflectance at 0.45 $\mu\text{m} < 0.92$)	$PC1' = -3PC2' + 1.00$	Line γ
Xc	Red and featureless with slight concave down curvature	$PC1' = -3PC2' + 1.50$	Line δ
Xe	Concave-up absorption feature before 0.55 μm	$PC1' = \frac{1}{3}PC2' + 0.50$	Line ϵ
Xk	Red shortward of 0.75 μm and generally flat longward of 0.75 μm	$PC1' = \frac{1}{3}PC2' - 0.10$	Line ζ
		$PC1' = \frac{1}{3}PC2' - 0.50$	Line η
		$PC1' = -3PC2' + 0.70$	Line θ

¹These spectral features are originally defined in Bus (1999) and Table 2 of Bus and Binzel (2002).

Table 2: IR Flowchart

IR Step 1: End Members

Does it satisfy: $\text{PCir1}' \geq 0.5$	$\xrightarrow{\text{yes}}$	V
↓ no		
Does it satisfy all: $0.29 \leq \text{PCir1}' < 0.5$ $\text{PCir5}' \leq 0.05$	$\xrightarrow{\text{yes}}$	Sv, Sr
↓ no		
Does it satisfy all: $\text{PCir2}' \leq -0.5$ $\text{PCir4}' \geq 0.15$ $-0.40 < \text{PCir1}' \leq 0$	$\xrightarrow{\text{yes}}$	O
↓ no		
Does it satisfy all: $0.25 \leq \text{PCir2}' < 0.5$ $\text{PCir5}' \geq 0.06$ $\text{PCir3}' \geq 0.05$	$\xrightarrow{\text{yes}}$	R
↓ no		
Does it satisfy all: Below line 1 $\text{PCir3}' \leq -0.02$ $\text{Slope}_{ir} \geq 0.24$	$\xrightarrow{\text{yes}}$	D
↓ no		
Does it satisfy all: $\text{PCir1}' \leq -0.4$ $\text{PCir2}' \leq -0.2$ $\text{PCir4}' \geq -0.07$ $\text{Slope}_{ir} \geq 0.5$ $\text{PCir3}' \geq 0$	$\xrightarrow{\text{yes}}$	A
↓ no		
Does it satisfy all: $\text{PCir1}' \leq -0.4$	$\xrightarrow{\text{yes}}$	Sa
↓ no		

Step 2

IR Step 2: S-complex

Does it lie on or above line 1 and 2? \xrightarrow{yes} S, Sr, Sq, **Q**
 \downarrow no

Does it lie on or above line 1 and between line 2 and 3? \xrightarrow{yes} S, Sq, Q, L, K
 \downarrow no

Does it line on or above line 1 and on or between line 3 and 4? \xrightarrow{yes} K, L, Sq
 \downarrow no

IR Step 3

IR Step 3: C- and X-complexes

Does it satisfy:
Below line 1 and on or between 3 and 4? \xrightarrow{yes} X-, C-complexes, L, K, T
 \downarrow no

Does it satisfy:
Below line 1 and between 2 and 3? \xrightarrow{yes} X-, C-complexes

\downarrow no
Does it satisfy:
Below line 1 and 4? \xrightarrow{yes} C, B, L, Cb, X

\downarrow no

Indeterminate

IR Equations

PCir3' =PCir2' - 0.08 Line 1
PCir1' =PCir2' + 0.15 Line 2
PCir1' =PCir2' - 0.10 Line 3
PCir1' =PCir2' - 0.40 Line 4
